



Impact of fishmeal from *Plectroponus moculates*, *Crenimugil crenilabis* and *Naso unicorns* (Pisces) on growth performance of broiler chicks

Amani. K. Ibrahim¹, Abdalla N. Elawad^{2*} and Zuheir N. Mahmoud³

1. Department of Zoology, Faculty of Education, Red Sea University.

2. Fisheries and Aquatics Animal Research Center, Khartoum. Sudan.

3. Department of Zoology, Faculty of Science, University of Khartoum.

*Corresponding address: al_awad2002@hotmail.com



Abstract

Fishmeal is made from fish by catch, market reject, undesirable sizes and the filleting waste from the processing of the fish to test its impact on broiler chick growth. A control broiler chick feeds and three levels of fishmeal meals made from *Plectroponus mocolates*, *Crenimugil crenilabis* and *Naso unicorns* were used as a broiler chick growth promotor in a completely randomized experiment. Very highly significant growth correlation ($p < 0.001$) was found in chicks group fed control feed. The calculated $r = 0.972$ was higher than the tabulated $r = 0.924$. Feeds 1, 2 and 3 yielded significant growth correlation ($p < 0.05$). The calculated r -value ranged from 0.796 to 0.832 and the tabulated ($r = 0.707$). Daily feed intake ranged from 85.45 to 97.81g, while daily weight gain, 30.60 to 32.94g.

Keywords: Fishmeal, Poultry, Growth.

Introduction

Fish as affordable food is an important commodity because of its contents of protein and essential amino acids as well as fat and fatty acids (Hagar *et al.*, 2021). Fish as a diet promotes healthy growth and maintains the body functions. The fish fatty acids are saturated containing omega 3 that helps in reducing the cholesterol level in the body (Artemis, 2008). Fish contain many minerals and vitamins that have an important role for building the body (FAO, 2002). Fish has an acceptable taste, can be prepared as meal in several ways

Fishmeal is made from fish by catch, market reject, undesirable sizes and the filleting waste from the processing of the fish to promote broiler chick growth. It is rich in protein, energy,



minerals, vitamins and micronutrients (Anonymous, 2000), high nutrient and excellent digestibility (Fickler, 2002) and a natural source of anti-oxidant (Cho and Kim, 2011). The standard composition of fish meal is 88% dry matter, 59% protein, 3.9% fat, 1.0% fibers (Jacob, 2022). A variety of fish species have been used in poultry diets and, when formulated to be equal in the various essential nutrients, provide similar growth results (Yamaneet *al.*, 1982). Within the European Union about 50% of fishmeal is used in aquaculture, 20% in poultry, 20 % in pigs and 10% in other markets; mainly pet food (Anonymous, 2002).

According to Naylor *et al.*, 2000; Karimi, 2006 and Beski *et al.*, 2015, fishmeal is a nutrient-rich and a very important high quality protein source in poultry nutrition. Kharag (2019) studied the effect of fishmeal made from marine fish waste on performance of broiler chickens and reported significant differences ($p < 0.05$) between groups in body weight. Fishmeal is sometimes used as a high quality organic fertilizer (Naylor *et al.*, 2000). Marine fishes of the Sudan have been arbitrary divided into first, second and third grade fish. Examples of these are the red emperor (*Plectroponus maculatus*) grade I, mullet fish (*Crenimugil crenilabis*), as grade II and unicorn fish (*Naso unicorns*) as grade III. This subjective grading is evaluated on grounds of gross chemical composition and body parts analysis (Mohammed *et al.*, 2022) and inclusion in experimentally designed feeding tests. The present study aimed to evaluate the impact of fishmeal from *P. maculatus*, *C. crenilabis* and *N. unicorns* on broiler chick growth.

Material and methods

Fish source

Highly fresh *P. maculatus*, *C. creiabis* and *N. unicorns* were purchased from Port Sudan Central Fish Market. Specimens were kept chilled till processed in the laboratory. Fish were washed, blot dry and dried till a constant weight is obtained in an electric oven (Kat-NR.2851, Elektroheliol, Sweden) at $105\pm 1^{\circ}\text{C}$.

Each dried fish species was grinded into powder in a clean electric grinder. Standard poultry diet was purchased from a retail seller. Experimental feeds were prepared prior to feeding using a balance of 0.1g accuracy. The same balance was used to record chicks weight.

Poultry chicks feeding experiment

The experiment was counted in a private farm adopting the closed system. The temperature was controlled by using fans and air conditioners. Vaccination and immunization followed the standard protocol (Table 1). The pens were cleaned according to standard procedures. Sample chick used (Lohman) 1-day age and 32.5g body weight.

Table 1. Standard vaccination protocol.

Day	Vaccines
1- 5	Antibiotic, Ati-Salmonella, neomycin and vitamin complex.
7	Newcastle plus.
12	(IBD) Gambaro.
15	Penicillin.
17	Anti-coccidian and vitamin complex.



This study was carried out to investigate the effects of formulated four diets varying in fishmeal levels (2:1, 1:1, 1:2 and a control 0:1) coded as feed1, 2, 3 and control, respectively. A total of 150chicks were allocated to each of these four dietary treatments which were replicated three times (5 chicks per pen) in a completely randomized design. Water and feed were available *ad libitum*.

The assessment of the nutritive value of each fish species was determined based on feeding experiments from 1-day old chicks till day 42 according to the following protocol:

Four groups (1 control+ 3 experimental) X 5 chicks in each group X 3 replicates X 3 feeds ratio. The food ratios were 2 fish powder +1 flour; 1 fish powder + 1flour and 1 fish powder+ 2flour.

The food ratio was calculated and adjusted every 4 days. Feeding ratio for chicks in each pen in gm/day was adjusted as follows: 1st, 4st, 8th, 12th, 16th, 20st, 24th, 28th, 32nd, 36thand 40th. The weight of each chick was recorded daily for up to day 42.

Statistical analysis

The data was compared using the least significant difference (LSD) test. The growth in body

weight over time was quantified by simple regression analysis.

Results

The following description of growth of chick feed from day 1 to day 42 was based on feed adjustment. Feed was adjusted every fifth day based on the average gain in chick body weight in each group. The mean body weight in each cell in a column (feed1,2, 3 and the control) was based on a triplicate and.

In Table 2 means with different superscripts in a row are significantly different ($p < 0.05$), while means in a column with different subscripts are significantly different ($p < 0.05$). There are no significant differences ($p > 0.05$) between the body weight gain of chick by the end of day four. The superscripts attached to the mean were similar in chicks fed Feed 1, Feed 2, Feed 3 and the control (Table 2 and Fig. 1).

1. From day 5 to day 12, the three feeds showed progressive growth with no significant difference between them ($p > 0.05$). The control showed highly significant difference ($p < 0.001$) as compared with feeds 1, 2 and 3.
2. As from day 13 to day 36, the chicks showed progressive gain in body weight (Fig. 1) with different level of significance. However, the control group continued to show progressive significant body weight gains ($p < 0.001$).
3. By the end of the feeding experiment at day 42, chicks received experimental feed 1 or 2 or 3 gained body weight about 80% of chicks fed the control feed (Table 2 and Fig. 1).

Table 2. Weight in g of chicks (Mean \pm SD) fed on feed 1 (*P. maculatus*), feed 2 (*C. creiabis*) and feed 3 (*N. unicorns*).

Feeding from day	Feed 1	Feed 2	Feed 3	Control
1 to 4	32.25 ^a \pm 1.95	32.25 ^a \pm 1.95	32.33 ^a \pm 1.37	32.66 ^a \pm 1.96
5 to 8	77.16 ^a \pm 6.07	72.67 ^a \pm 3.22	70.42 ^a \pm 2.19	129.25 ^b \pm 9.21

9 to 12	99.4 ^a _c ±6.54	97.58 ^a _c ±9.10	105.25 ^a _c ±7.08	365.00 ^b _c ±29. 09
13 to 16	165.25 ^a _d ±18.5 1	150.17 ^b _d ±21.4 7	149.25 ^b _d ±15. 01	555.58 ^c _d ±34. 25
17 to 20	377.83 ^a _e ±34.2 2	281.17 ^b _e ± 27.6	331.75 ^c _e ±26.8 1	768.50 ^d _e ±29. 0
21 to 24	508.50 ^a _f ±25.6 9	421.67 ^b _f ±32.4 9	434.83 ^b _f ±43.1 6	1006.3 ^c _f ±9.4 0
25 to 28	774.92 ^{a,b} _g ±38. 81	800.17 ^{b,c} _g ±11. 82	832.33 ^c _g ±93.2 3	1235.5 ^d _g ±41. 98
29 to 32	1196.8 ^a _h ±61.4 1	1195.8 ^a _h ±12.7 0	1111.9 ^b _h ±88. 79	1574.3 ^c _h ±41. 98
33 to 36	1467.4 ^a _i ±47.9 4	1467.0 ^a _i ±72.0	1412.2 ^b _i ±20.8 0	1827.1 ^c _i ±10. 08
37 to 41	1768.1 ^a _j ±39.8 4	1767.9 ^a _j ±57.0 6	1761.1 ^a _j ±69.6 9	2184.5 ^b _j ±12 9.9

Superscripts in a row with different letters are statistically significantly different (p<0.05). Subscripts in a column with different letters are statistically significantly different (p<0.05).

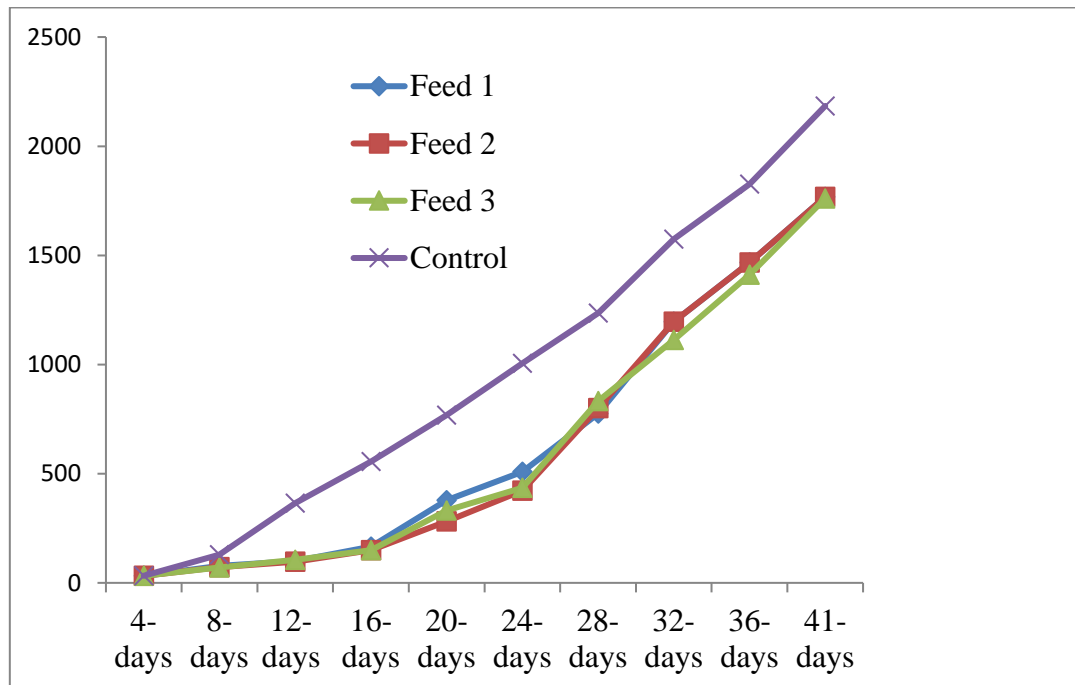


Fig. 1. Growth rate during the feeding experiments

Simple regression analyses of changes in body weight of chick's receiving experimental and control diet with time (Table 3) showed that:

1. Very highly significant growth correlation ($p < 0.001$) was found in chicks group fed control feed. The calculated $r = 0.972$ was higher than the tabulated $r = 0.924$.

2. Feeds 1, 2 and 3 yielded significant growth correlation ($p < 0.05$). The calculated r-value ranged from 0.796 to 0.832 and the tabulated ($r = 0.707$) Table 3.

Table 3. The relationship between increase in body weight over time.

Species	Regression equation	r calc.	r tab.	p
<i>Plectroponus maculatus</i>	$Y = 199.7X - 446.6$	0.832	0.707	$p < 0.01$
<i>Crenimugil crenilabis</i>	$Y = 199.7X - 470.1$	0.796	0.707	$p < 0.05$
<i>Nasounicornis</i>	$Y = 194.7X - 447$	0.813	0.707	$p < 0.05$
Control	$Y = 239.8X - 351$	0.972	0.924	$p < 0.001$

Discussion

In Sudan, nutritional merit of fish species is useful in classifying it as grade I, II and III (Babiker, 1981). The protein level in fishmeal is a determinant factor for of broiler check growth (Karimi, 2006; Anonymous, 2000; Fickler, 2002; Cho and Kim, 2011) and aquaculture (Chong *et al.*, 2004). The protein in the tissues varies according to many factors, the most important of which is the physiological condition and the health of fish **Barua et al. (2012)**. The fishmeal quality and its impact on growth performance, depends on its components of total fat and protein (measure of its calorific value) and their ratio as a measure of digestibility (Mohammed *et al.*, 2022). The protein and fat percentages in *P. maculatus* were 26.14 and 3.89; in *C. creiabis* were 23.75 and 14.18, and in *N. unicornis* were 22.28 and 10.16.64, respectively (Mohammed *et al.*, 2022). Thus the caloric



value in the three species was record was for *P. macultus*, *C. creiabis* and the lowest for *N. unicorns*.

Fishmeal is a brown powder which normally contains a high level of protein and appreciable quantities of fat and minerals (Anonymous, 2002). The growth weight of poultry fed with *P. maculatus* diets during first 24 days was higher and showed similar growth pattern towards the end of the experiment.

Fishmeal improves broiler growth (Yamaneet *al.*, 1982; Boldaji *et al.*, 1998; Karimi, 2006; Jassim, 2010; Cho and Kim, 2011; Silva *et al.*, 2017). Fish meal is of value in promoting aquaculture yield (Miles and Chapman, 2005).

Fishmeal contains a good balance of amino acids, including methionine and lysine. In addition to high levels of essential amino acids, fishmeal has a good balance of unsaturated fatty acids, certain minerals like calcium and phosphorus, and vitamins A, D, and B-complex (Yamaneet *al.*, 1982; Cho and Kim, 2011).

Conclusions

The results of this experiment indicated that the beneficial effects of fishmeal on broiler performance becomes most evident at higher use levels and during the latter growth periods, mainly via stimulation of feed intake.

Ethics. Ethics approval and consent to participate, human and animal rights, consent for publication, availability of data and materials are not applicable.

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Conflict of Interest. The authors declare no conflict of interest, financial or otherwise.



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